OCR
Oxford Cambridge and RSA

F

Friday 14 June 2019 – Morning

GCSE (9–1) Combined Science (Physics) A (Gateway Science)

J250/06 Paper 6 (Foundation Tier)

Time allowed: 1 hour 10 minutes

7710036171

You must have:
- a ruler (cm/mm)
- the Data Sheet (inserted for GCSE Combined Science (Physics) A)

You may use:
- a scientific or graphical calculator
- an HB pencil

J250006

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

SECTION A

You should spend a maximum of 20 minutes on this section.

Answer **all** the questions.

Write your answer to each question in the box provided.

1 Which statement describes what human eyes can detect?

A Limited range of electromagnetic waves.

B Limited range of sound waves.

C Wide range of electromagnetic waves.

D Wide range of sound waves.

Your answer ☐ **[1]**

2 Which of the following factors affects thinking distance **and** braking distance for a car?

A Tiredness of the driver.

B Worn out brakes.

C Worn out tyres.

D The speed of the car.

Your answer ☐ **[1]**

3 A student completes four calculations for work done.

Which row of the table is correct?

Use the equation: work done = force × distance

	Force (N)	Distance (m)	Work done (J)
A	100	2	200
B	100	3	33
C	200	2	100
D	200	3	467

Your answer ☐ **[1]**

4 Which statement is correct?

A Changes in atoms and nuclei can generate radiations over a wide range of frequencies.

B Changes in atoms and nuclei can generate radiations over a narrow range of frequencies.

C Changes in atoms and nuclei do not generate radiations.

D Changes in atoms and nuclei always generate radio waves.

Your answer ☐ **[1]**

5 What is the typical value for a human reaction time to a stimulus?

A 0.02 s

B 0.2 s

C 0.8 s

D 1.2 s

Your answer ☐ **[1]**

6 A 30 kW boiler is used for 4 hours.

Calculate the energy transferred.

Use the equation: energy transferred = power × time

A 7.5 kWh

B 120 kWh

C 7500 kWh

D 120 000 kWh

Your answer ☐ **[1]**

7 The specific latent heat for melting ice is 334 000 J / kg.

Calculate the thermal energy needed to melt 2.0 kg of ice.

A 167 J

B 668 J

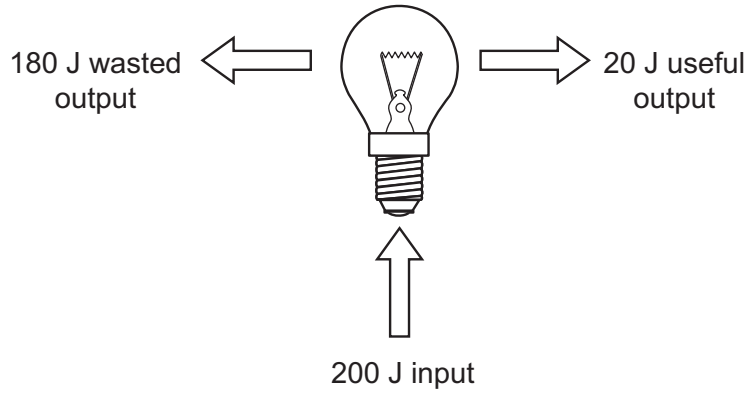
C 167 000 J

D 668 000 J

Your answer ☐ **[1]**

8 Calculate the efficiency of this light bulb.

Use the equation: efficiency = useful output energy transfer ÷ input energy transfer



A 0.1

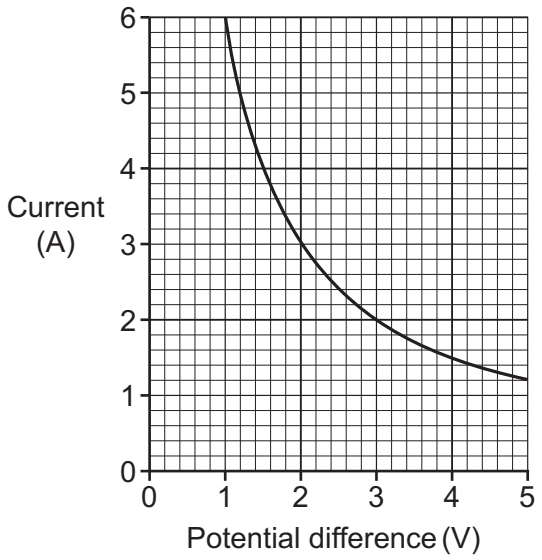
B 0.8

C 0.9

D 1.0

Your answer ☐ **[1]**

9 This graph shows current and potential difference for the secondary coil of a transformer.



What happens to current as potential difference **doubles**?

A It doubles

B It halves

C It stays the same

D It triples

Your answer ☐ **[1]**

10 An astronaut lifts a 0.25 kg hammer 1.0 m above the surface of the Moon.

The gravitational field strength on the Moon is 1.6 N / kg.

Calculate the potential energy stored.

Use the equation: potential energy = mass × height × gravitational field strength

A 0.16 J

B 0.40 J

C 6.40 J

D 400 J

Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

11 Electromagnetic waves are usually divided into seven different groups.

(a) This diagram of the electromagnetic spectrum is incomplete.

Complete the diagram by adding the missing parts of the electromagnetic spectrum.

	microwaves	infra-red	visible light		X-rays	gamma rays

[1]

(b) Sound is **not** part of the electromagnetic spectrum.

Explain why.

.....

..... **[1]**

(c) All waves have a **frequency.**

(i) Which part of the electromagnetic spectrum has the **highest** frequency?

..... **[1]**

(ii) What happens to the wavelength of an electromagnetic wave as the frequency increases?

Tick (✓) **one** box.

Decreases ☐

Increases ☐

Stays the same ☐

[1]

(d) Describe how X-rays and gamma rays can damage humans.

.....

..... **[1]**

12 A student investigates the stopping distance of a toy car.
He looks for a relationship between angle of slope and stopping distance as shown in **Fig. 12.1**.

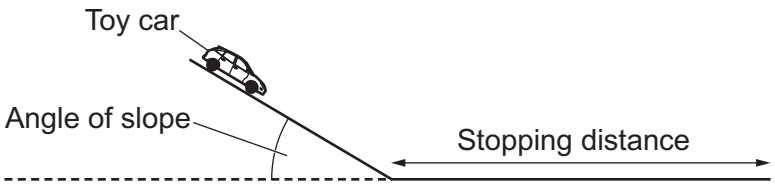


Fig. 12.1

(a) Complete **Table 12.1** to show the apparatus he needs.

Measurement	Apparatus needed
angle of slope	
stopping distance	

[2]

Table 12.1

(b) Describe **two** things the student should do to get precise and repeatable results.

1 .....

.....

2 .....

.....

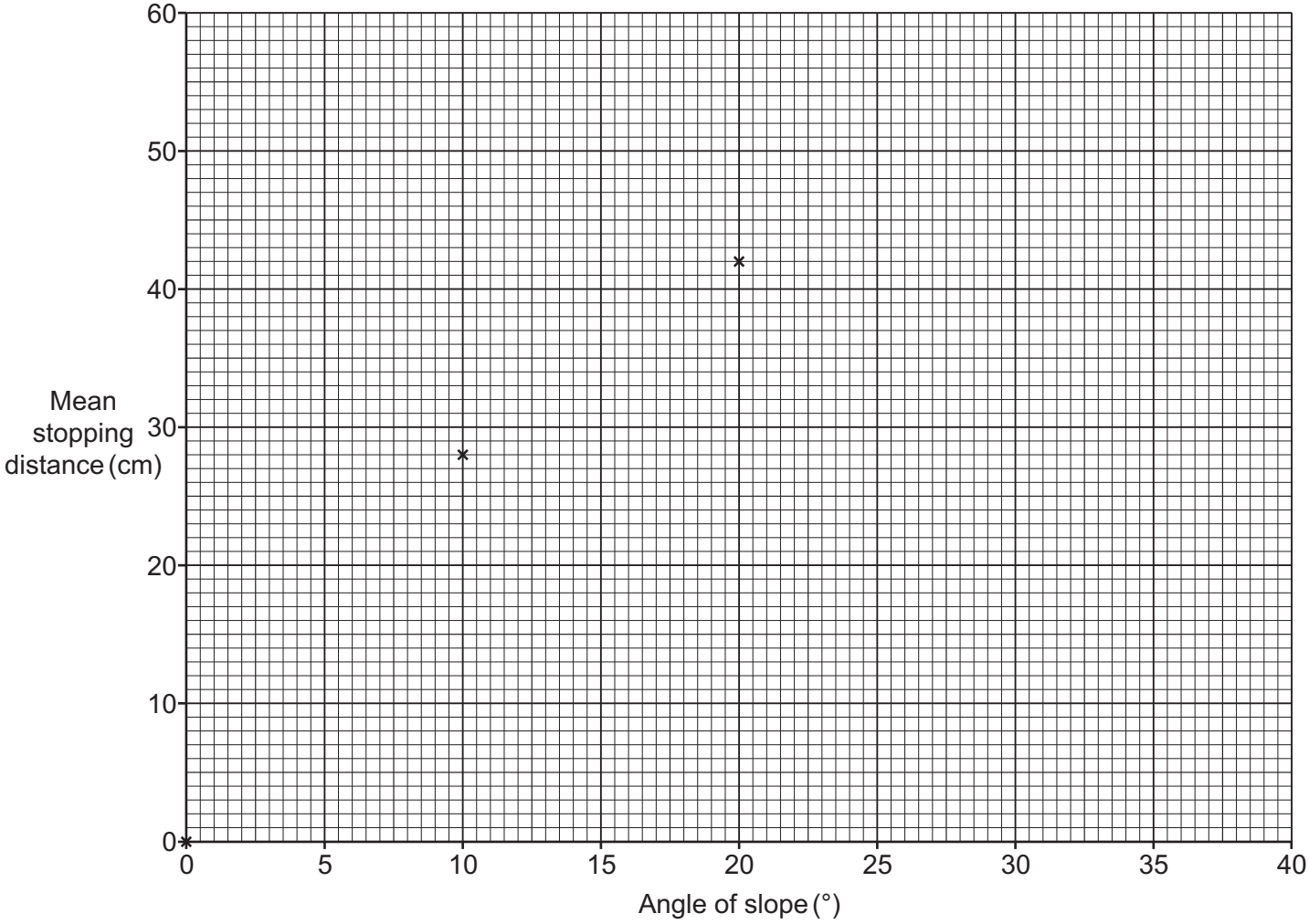
[2]

(c) **Table 12.2** shows the results from the experiment.

Angle of slope (°)	Stopping distance (cm)		
	Attempt 1	Attempt 2	Mean
0	0	0	0
10	28	27	28
20	42	44	43
30	50	55	53
40	56	57	57

Table 12.2

(i) Plot the results from **Table 12.2** on the axes below and draw a curve of best fit.
The first three points have already been plotted for you.



[2]

(ii) Describe the relationship shown by the graph.

.....

.....

..... **[2]**

(iii) Use the graph to estimate the mean stopping distance at an angle of 15°.

Mean stopping distance = ... cm **[1]**

(iv) Explain why the result at 30° in **Table 12.2** is the **least** precise.

.....

..... **[1]**

(d) Energy is transferred as the toy car moves from point **X** to point **Y**, as shown in **Fig. 12.2**.

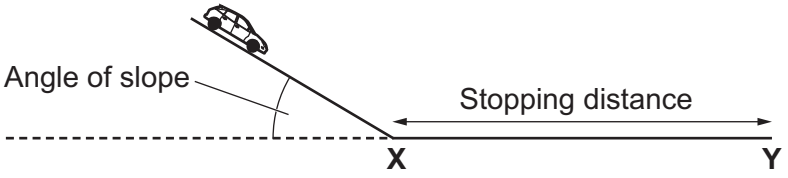


Fig. 12.2

Write down the energy store that increases and the energy store that decreases as the toy car in **Fig. 12.2** moves from point **X** to point **Y**.

Energy store that increases .....

Energy store that decreases .....

[2]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

13 This question is about radioactive atoms.

(a) Why are some atoms radioactive?

.....

..... **[1]**

(b) Phosphorus-32 ($^{32}_{15}P$) gives out beta particles.

(i) Complete the equation for the beta decay.

$$^{32}_{15}P \longrightarrow \underset{\ldots\ldots}{^{32}S} + \underset{}{^{\ldots\ldots}_{-1}\beta}$$

[2]

(ii) Phosphorus-32 **only** gives out beta particles.

Describe a simple experiment to show how this can be demonstrated in a laboratory.

You may include a diagram in your answer.

.....

.....

.....

.....

.....

.....

.....

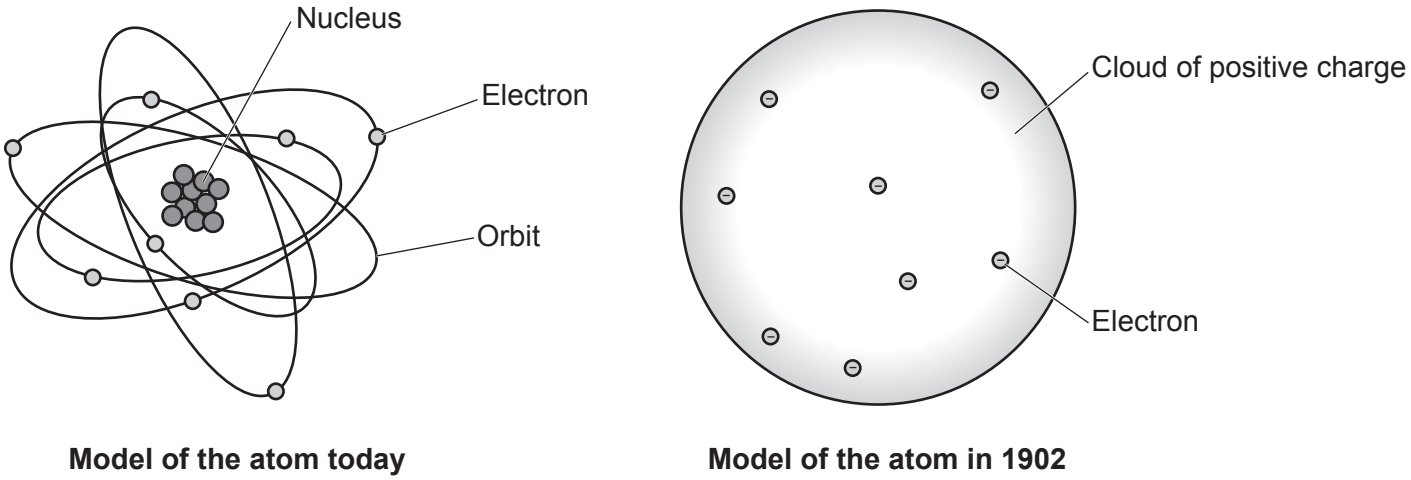
..... **[4]**

(c) Beta particles are one type of radioactive particle.

Name a **different** particle given out by radioactive atoms.

..... **[1]**

(d) Look at the diagram.
It compares the model of the atom today with a model of the atom in 1902.



Model of the atom today **Model of the atom in 1902**

(i) Describe **two** differences between the models in the diagram.

1 .....

.....

2 .....

..... **[2]**

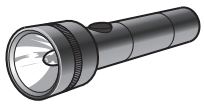
(ii) Explain why the model of the atom has changed over time.

.....

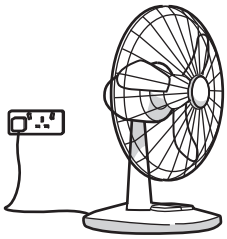
..... **[1]**

14 This question is about electrical devices.

(a) The diagram shows two different electrical devices.



Torch



Electric fan

(i) Write down the source of electrical energy for each device.

torch .....

electric fan ..... **[1]**

(ii) Describe how energy is dissipated in the **electric fan**.

.....

..... **[1]**

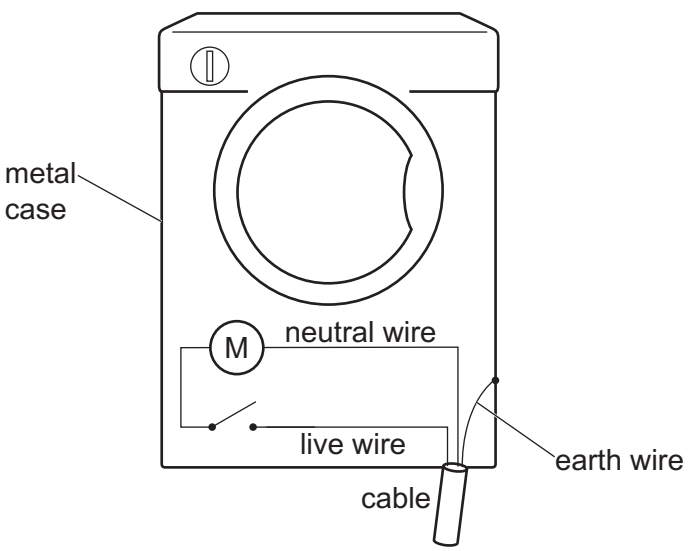
(iii) The electric fan is rated 230 V, 0.3 A.

Calculate the power of the electric fan.

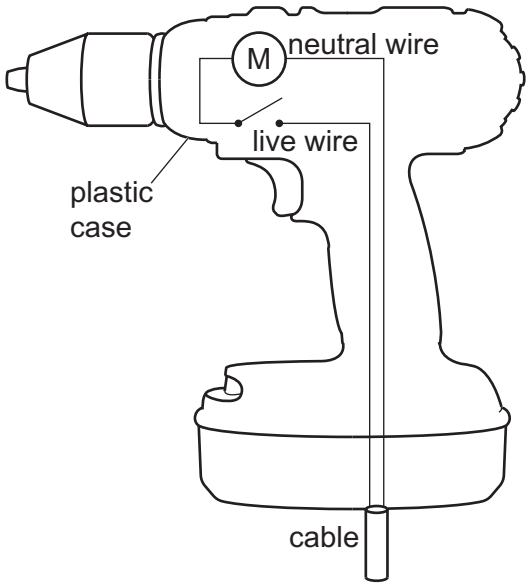
Use the equation: power = potential difference × current

Power = ... W **[2]**

***(b)** Here is a diagram of a **tumble dryer** and an **electric drill**.
Each appliance is wired differently.



Tumble dryer



Electric drill

Explain whether the **tumble dryer** and **electric drill** are both safe to use.

Include the function of the earth, live and neutral wires in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

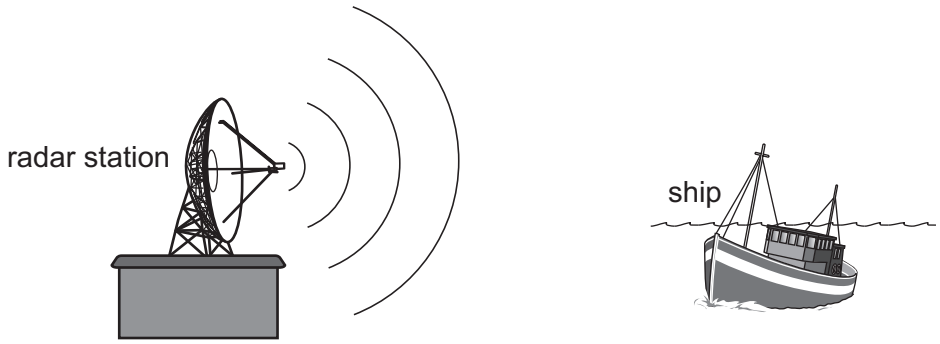
.....

.....

.....

..... **[6]**

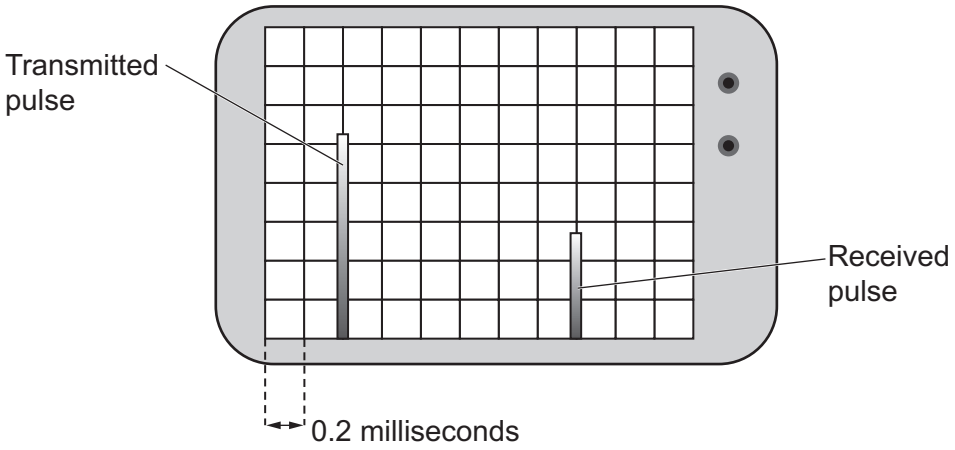
15 Radar stations can be used to find out where ships are.



At a radar station:

- a radar transmitter transmits pulses of microwaves
- the pulses are reflected by the ship
- a radar receiver detects the pulses.

(a) The diagram shows the radar signals on an oscilloscope screen:



(i) Calculate the time taken between the pulse being transmitted and received.

Time taken = ... ms **[1]**

(ii) A radar signal is sent from the radar station. The signal reflects off the ship and is detected 0.0006 s later.

The speed of the microwaves is 3.0×10^8 m / s.

Calculate the distance of the ship from the radar station.

Use the equation: distance travelled = speed × time

Distance = ... m **[2]**

(iii) The amplitude of the received pulse is lower than the transmitted pulse.

Suggest why.

.....

..... **[1]**

(b) Radar stations use microwaves with a frequency of 200 MHz.

The speed of the waves is 3.0×10^8 m / s.

Calculate the wavelength of these waves.

Wavelength = ... m **[4]**

16 This question is about radioactive decay.

A teacher models radioactive decay using 100 dice:

- she shakes a beaker containing 100 dice and empties the dice into a tray
- every time a number "6" lands face up, she removes that dice
- she places the remaining dice in the beaker and repeats the process.

Here are some of the results from this experiment.

Number of throws	Number of dice removed				Number of dice remaining
	Attempt 1	Attempt 2	Attempt 3	Mean	
1	16	18	17	17	83
2	15	14	14	14	69
3	10	12	11	11	58
4	10	9	10	10	48
5	8	9	7	8	40

(a) Describe the difference between **mean**, **mode** and **median**.

In your answer use data from the second throw in the table (shaded in grey).

.....

.....

.....

.....

..... **[3]**

(b) Use the table to estimate the half-life of the dice.

Give your answer to the **nearest whole number**.

Half-life = ... throws **[1]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).